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RF/ER-95-111.UN

Proposed Action Memorandum for the Source Removal at Trenches T-3 and T-4 IHSSs 110 and 111.1

DOCUMENT CLASSIFICATION
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CLASSIFICATION OFFICE

March 28, 1996
Revision 2

PROPOSED ACTION MEMORANDUM FOR THE SOURCE REMOVAL AT TRENCHES T-3 AND T-4 IHSSs 110 AND 111.1

March 28, 1996

Revision 2
Document Control Number RF/ER-95-0111.UN

PROPOSED ACTION MEMORANDUM
FOR THE SOURCE REMOVAL AT TRENCHES T-3 AND T-4
IHSSs 110 AND 111.1

TABLE OF CONTENTS

ACRONYMS

ARARs . . . . Applicable or Relevant and Appropriate Requirements
IAG . . . . . Interagency Agreement
IHSS . . . . . Individual Hazardous Substance Site
MCLs . . . . . Maximum Concentration Levels
NAPL . . . . . Non-aqueous Phase Liquid
NEPA . . . . . National Environmental Policy Act
OSHA . . . . . Occupational Safety and Health Administration
OU . . . . . Operable Unit
PCE . . . . . Tetrachloroethene or Perchloroethene
PCOC . . . . . Potential Contaminant of Concern
PPRGs . . . . Programmatic Preliminary Remediation Goals
RCRA . . . . . Resource Conservation and Recovery Act
RFA . . . . . Rocky Flats Alluvium
RFETS . . . . Rocky Flats Environmental Technology Site
RFI/RI . . . . RCRA Facility Investigation/Remedial Investigation
TCE . . . . . Trichloroethene
TDU . . . . . Thermal Desorption Unit
TPH . . . . . Total Petroleum Hydrocarbons
UHSU . . . . Upper Hydrostratigraphic Unit
UTS . . . . . Universal Treatment Standards
VOCs . . . . . Volatile Organic Compounds

1.0 PURPOSE

This source removal action is proposed to remove the contaminated soils in Trenches T-3 and T-4 at the Rocky Flats Environmental Technology Site (RFETS) to reduce risk and to protect groundwater in the area. Sanitary sewage sludge contaminated with uranium and plutonium and miscellaneous wastes were deposited in the two trenches for a period spanning three years, first using T-3 and continuing disposal in T-4, before the trenches were backfilled and their use discontinued. On the basis of site characterization data from the Operable Unit 2 RCRA [Resource Conservation and Recovery Act] Facility Investigation/Remedial Investigation (RFI/RI), volatile organic compounds (VOCs) were observed in soil in the two trenches and groundwater contamination observed originating from the trenches.

Under this proposed action, the contaminated soils and debris will be removed from the trenches and processed using thermal desorption. At the conclusion of the project, the trench sites will be restored to a comparable undisturbed condition. The intent of this source removal is to capture the contaminants of concern that may leach into the groundwater. The groundwater at T-3 and T-4, which was impacted by the contaminants disposed in the trenches, will be addressed as part of the site groundwater management strategy.

2.0 PROJECT DESCRIPTION

Information on construction, contamination history, geology and hydrogeology for the trench sites has been collected over many years and documented in various reports. The most thorough presentation of this information for Trench T-3 is *Technical Memorandum No. 4, Site Model for Hydrogeological/Contamination Distribution for Trench T-3.* Information on Trench T-4 is taken from the *Phase II RFI/RI Report for Operable Unit No. 2* and from the characterization study conducted in the spring of 1995. The location of both trenches is shown in Figure 2.1.

In evaluating the risk associated with the contamination in Trenches T-3 and T-4, the exposure pathway for construction worker subsurface soils was used in assessing Programmatic Preliminary Remediation Goals (PPRGs). The cleanup standards that will be used for determining the extent of excavation are the RFETS site-specific cleanup standards protective of groundwater. These standards are established to protect groundwater from mobile contaminants such as VOCs. The performance, or treatment standard, for the thermal desorption unit, will be the universal treatment standards (UTS) for the contaminants of concern. No modification of the corrective action section of the operating permit for RFETS will be required for this action since the project will be conducted under CERCLA.

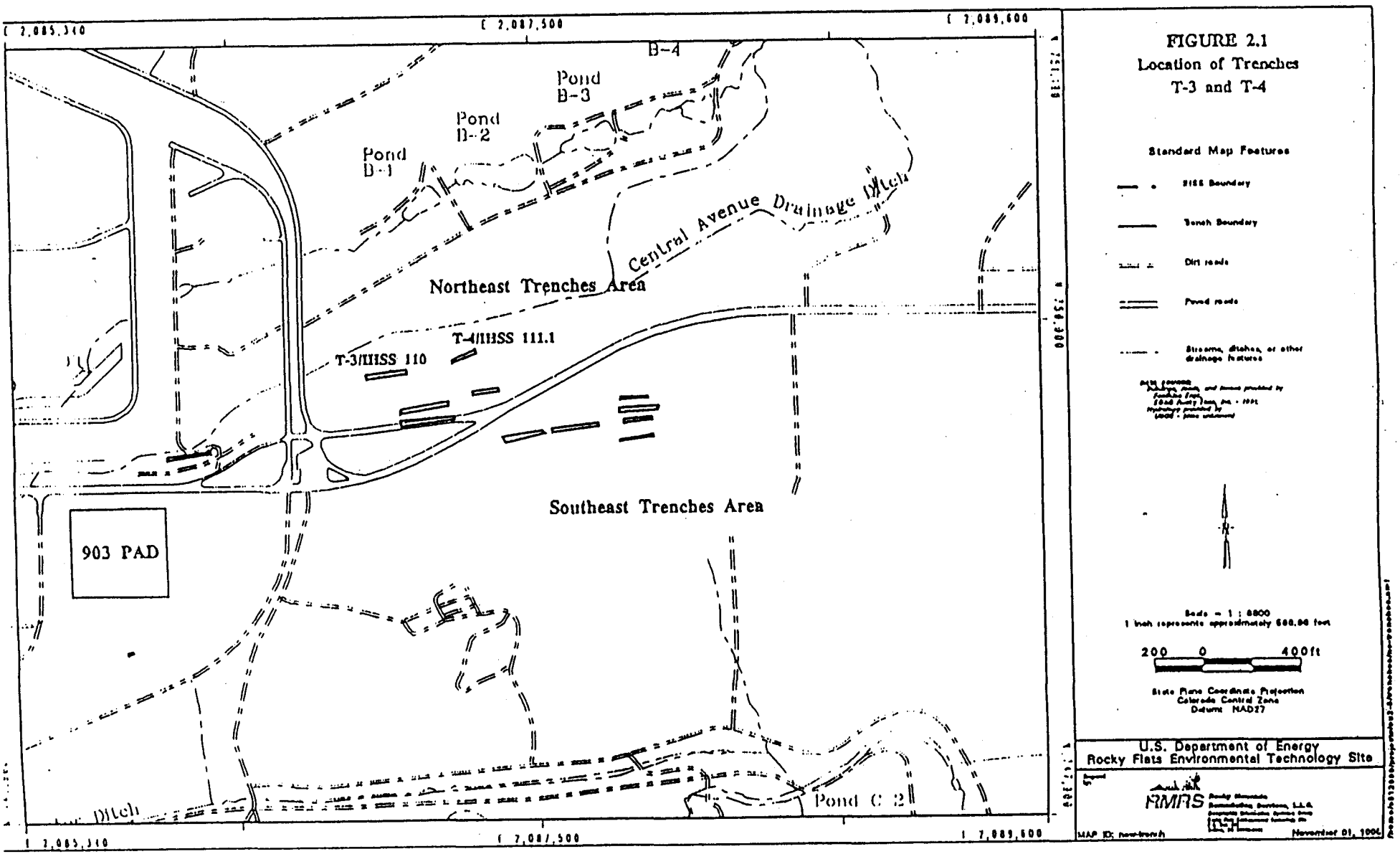


FIGURE 2.1
Location of Trenches
T-3 and T-4

2.1 BACKGROUND

Based on historical aerial photographs and records, Trench T-3, also known as Individual Hazardous Substance Site (IHSS) 110, was used from approximately October, 1964 through April, 1966. Trench T-4, also known as IHSS 111.1, was used from approximately April, 1966 through April, 1967. Both trenches were used to dispose of sanitary sewage sludge contaminated with uranium and plutonium and miscellaneous wastes. Flattened empty drums also contaminated with uranium and plutonium were disposed in the trenches. There are no reports of metallic nuclear materials deliberately buried in the trenches, and data collected during the remedial investigation indicate that the levels of radiological contamination are below the risk-based PPRGs for subsurface soils. There is also no documentation of listed wastes being placed in the trenches.

No inventory of the miscellaneous wastes disposed of in these trenches has been found and probably does not exist. The total volume and chemistry of the wastes is thus not known. Records do exist for the following:

- An unknown volume of radiologically contaminated asphalt-impregnated felt from the solar pond (207A) may have been placed in the trench.
- An unknown volume of liquid waste from Bldg. 444.
- Plutonium-contaminated asphalt from IHSS 117.3.
- An unknown number of crushed U-238-contaminated drums from use at the oil burn pit number 2 (IHSS 153).

Trench T-3 was constructed by bulldozing to a maximum depth of approximately ten feet. Dimensions of T-3 are approximately 20 feet by 134 feet as observed through geophysical methods. The trench appears to be deepest at the west end, with a gradually sloping access ramp to the east. Waste was placed in the western 50 to 100 feet of the trench and covered by approximately two feet of overburden. Trench T-4 was constructed in a manner similar to T-3. The dimensions are approximately 20 feet by 125 feet. Trench T-4 is approximately ten feet deep.

Both trenches are located in an area where surficial soils are contaminated with low levels of americium-241 (Am-241) and plutonium-239/240 (Pu-239/240). These contaminants were deposited by wind transport from the 903 Pad drum storage area after the trenches were no longer in use. The radiological contamination levels in the surficial soils are below PPRGs and are not detectable by hand-held measuring devices.

2.2 HYDROGEOLOGICAL SETTING

Site data indicates the hydrogeologic setting of the T-3 and T-4 trench area is as follows:

- Stratigraphy consists of 17 to 20 feet of Rocky Flats Alluvium (calcareous sandy gravel and clayey gravel) unconformably overlying approximately 35 feet of siltstone and sandstone of the No. 1 sandstone of the Arapahoe Formation, which unconformably overlies the massive claystone of the Laramie Formation.

- Groundwater occurs at a depth of 17 to 20 feet below ground surface. The groundwater flow direction in the Rocky Flats Alluvium is controlled by the medial paleoscour, south of the trenches, towards the east-northeast at a gradient of 0.02 ft/ft. The groundwater flow in the Arapahoe No. 1 sandstone is comprised of two flow components, one toward the north at a gradient of 0.1 ft/ft and the second toward the east-northeast along the trend of the sandstone lithofacies at a gradient of 0.027 ft/ft.

- Mean hydraulic conductivities of the Rocky Flats Alluvium, Arapahoe No. 1 sandstone, and unweathered sandstone/siltstone/claystone in the area are 8E-04 cm/s, 4.8E-04 cm/s, and 2E-06 cm/s, respectively.

- Water levels fluctuate as much as 10 feet in the Rocky Flats Alluvium and Arapahoe No. 1 sandstone in the area of the trenches due to seasonal recharge events.

- The nature and extent of VOC contaminants observed in groundwater originating from the T-3 and T-4 area extend to the north where VOC contaminants of concern (carbon tetrachloride [CCl4], tetrachloroethene [PCE], and trichloroethene [TCE]) are observed in the seeps, the B-series ponds (B-1, B-2 and B-3), and to the northeast approximately 1500 feet.

2.3 DATA SUMMARY

Subsurface soil and groundwater contaminant characterization of Trench T-3 and T-4 are summarized below.

2.3.1 Trench T-3 Contamination

Boreholes were drilled in the Trench T-3 area during November, 1994 for the purpose of locating and characterizing subsurface contamination. Monitoring wells have been drilled in the vicinity of the trench during the past ten years. The location of these boreholes and wells is shown in Figure 2.3.1. Groundwater samples were taken from upgradient wells (24393, 12191, and 2991) and one downgradient well (24993). The wells are screened in the Arapahoe Number 1 sandstone formation (see Phase II RFI/RI Report for OU 2 for detailed geological and hydrogeological information). The results of these samples are summarized in Table 2.3.1 and indicate an increase in VOCs in the groundwater after passing under the trench. The presence of VOC contamination in the upgradient wells has been traced, as documented in Technical Memorandum 4, to the 903 Pad or other trenches. Nonetheless, the increase in concentrations in the groundwater downgradient of the trench indicates T-3 is a source of groundwater contamination.

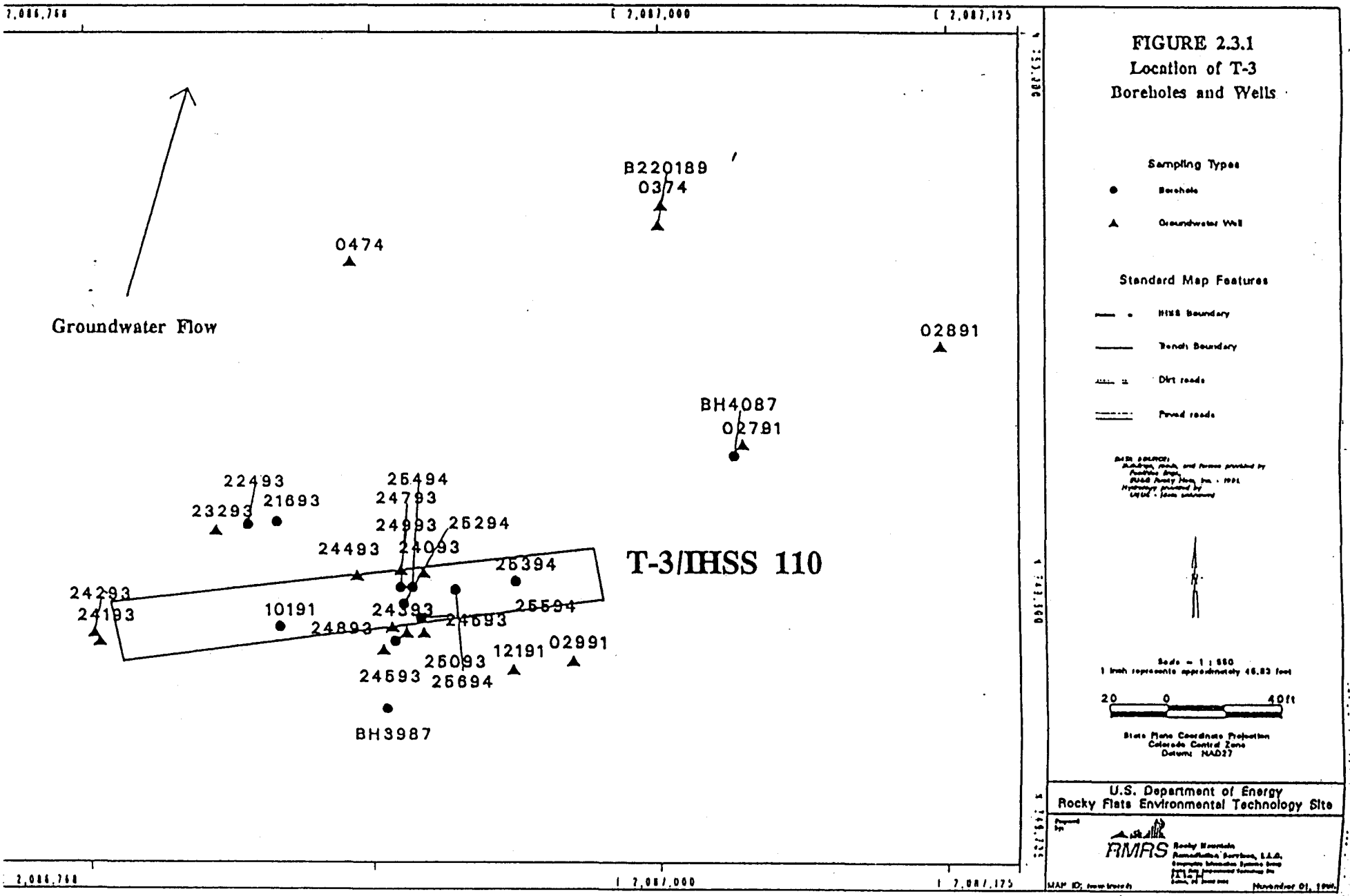

2,086,768
2,087,000
2,087,125
Groundwater Flow
B220189
0374
0474
02891
BH4087
02791
22493
25494
23293
21693
24793
24993
25294
24493
24093
25394
T-3/IHSS 110
24293
24193
10191
24393
25594
24893
24693
12191
02991
25093
24593
25694
BH3987
FIGURE 2.3.1
Location of T-3
Boreholes and Wells
Sampling Types
Borehole
Groundwater Well
Standard Map Features
IHSS Boundary
Trench Boundary
Dirt roads
Paved roads
Scale = 1 : 550
1 inch represents approximately 45.83 feet
20 0 40ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
RMRS
November 01, 1999

TABLE 2.3.1
T-3 GROUNDWATER SAMPLING RESULTS SUMMARY

	Maximum Concentrations (µg/l)				
	Upgradient Wells			Downgradient Well	Federal Drinking Water MCLs
Contaminant	24393	12191	2991	24993	
Carbon tetrachloride (CCl_4)	240	180	560	4100	5
Tetrachloroethene (PCE)	250	200	140	1600	5
Trichloroethene (TCE)	40	40	66	110	5
Toluene	5	10	2	30	1000

Detailed soil sampling data is presented in Table 2.3.2. The contaminants of concern are volatile organic compounds (VOCs).

Evidence of crushed drums was found in several locations during drilling in Trench T-3. Additionally, non-aqueous phase liquids (NAPL) were encountered in several locations as evidenced by film and muck witnessed on the drilling rig. However, the volume of NAPL is expected to be minimal since void spaces in the trench are not interconnected. Only one sample of the NAPL was recovered.

As reported in Technical Memorandum 4, a grab sample of liquid was collected from borehole 25194 in November of 1994 when the borehole was established. The sample showed four distinct layers of liquid: a top dark liquid layer, a clear layer, a yellow fluid layer, and another dark viscous fluid layer. The four original layers settled into two distinct layers: a floating oil layer and a more dense water layer. The upper oil layer contained 37 percent diesel, 17 percent gasoline, 4 percent PCE, 1 percent TCE, and 41 percent heavy oil constituents. The principal contaminants in the water layer were 650 ppm PCE and 97 ppm TCE.

It is important to note that no carbon tetrachloride contamination was detected in either oil or water samples from the NAPL in borehole 25194. Significant contamination levels were anticipated since several previous samplings at other locations showed high levels of carbon tetrachloride in the trench. This unusual result may indicate that the carbon tetrachloride contamination exists in a different part of the trench.

These data indicate that crushed drums were loaded into portions of the trench fairly densely and stacked on top of each other. Soil was either layered in the trench with the drums, or has sifted between the drums from the overburden. Liquid has settled into disconnected voids among the drums and in the pore space of the soil.

TABLE 2.3.2
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations[5]	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
Volatile Organic Compounds (mg/kg)[5]					
1,1,1-Trichloroethane	NA	22	8	36.4	0.006-27[J]
Acetone	NA	21	8	38.1	0.036-5100[B]
Carbon tetrachloride	NA	22	10	45.5	0.004[J]-700
Chloroform	NA	22	6	27.3	0.001[J]-8.8
Ethylbenzene	NA	22	1	4.5	0.009
Methylene chloride	NA	22	16	72.7	0.003[J]-2400[B]
Tetrachloroethene	NA	22	20	90.9	0.002[J]-13,000[D]
Toluene	NA	22	13	59.1	0.022-7.6[J]
Trichloroethene	NA	22	5	22.7	0.002[J]-120

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE 2.3.2 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations(5)	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
Semivolatile Organic Compounds (mg/kg)(5)					
2-Methylnaphthalene	NA	12	2	16.7	8.0(E)-9.3(E)
2-Methylphenol	NA	12	2	16.7	0.45-0.5(DJ)
4-Methylphenol	NA	12	2	16.7	2.9-3.6(D)
Bis(2-ethylhexyl)phthalate	NA	11	9	81.8	0.051(J)-6.3(D)
Di-n-butyl phthalate	NA	12	2	16.7	1.3-1.7(D)
Hexachlorobutadiene	NA	12	1	8.3	0.17(J)
Hexachloroethane	NA	12	2	16.7	0.37-1.1
Naphthalene	NA	12	2	16.7	0.96-2
Phenanthrene	NA	12	2	16.7	2.5-2.7

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE 2.3.2 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
PCOC Metals above background (mg/kg)[2]					
Arsenic	13.2	11	11	100	1.4[B]-9.2[B]
Barium	289	11	11	100	21.9[B]-251
Cadmium	1.7	11	4	36.4	0.74-0.88
Lead	24.9	11	11	100	3.1-86.4
Manganese	901.6	11	11	100	1.3[B]-1440[B]
Silver	24.6	11	7	63.6	1.1-96.5

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE 2.3.2 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
PCOC Radionuclides above background (pCi/g)[2][3]					
Americium-241	0.012	12	12	100	0.0007-0.598
Plutonium-239/240	0.018	12	12	100	0.009-3.12
Strontium-89/90	0.747	12	9	75	0.008[J]-0.748[J]
Tritium (pCi/l)	395.211	12	12	100	0.536-333[J]
Uranium-233/234	2.643	12	12	100	0.551-14.4
Uranium-235	0.114	12	12	100	0.0097[J]-0.751
Uranium-238	1.485	12	12	100	0.628-26.4

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

2.3.2 Trench T-4 Contamination

Boreholes were drilled and sampled in the Trench T-4 area in the spring of 1995 for the purpose of locating and characterizing subsurface contamination. Geophysical surveys and soil gas surveys of the trench were conducted to characterize the trench and to optimize borehole locations. Data from the spring 1995 field activities have not yet been compiled into a report.

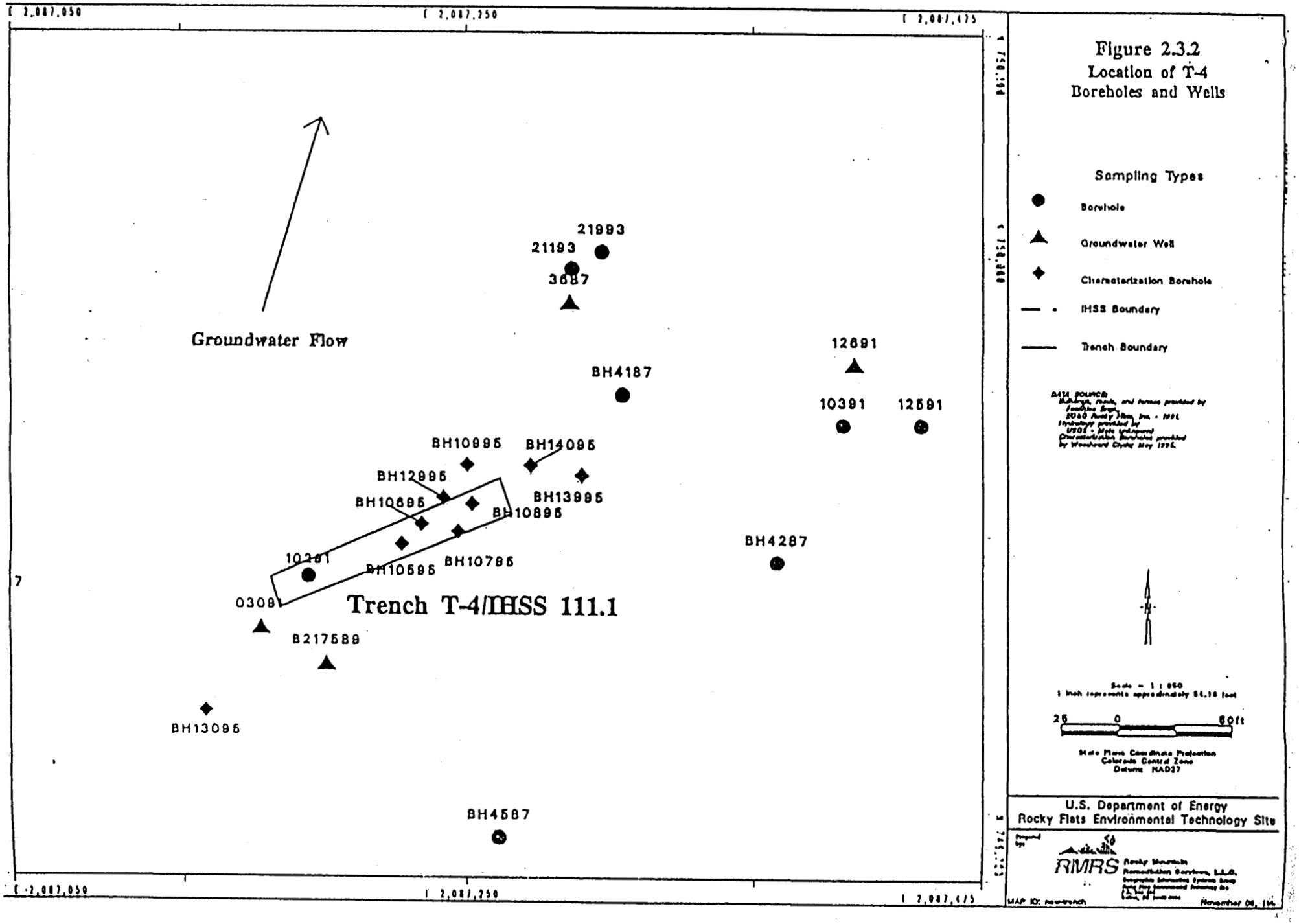
The location of these boreholes and wells is shown in Figure 2.3.2. Groundwater samples were taken from an upgradient well (3091) and downgradient wells (3687 and 12691). The wells are screened in the Arapahoe Number 1 sandstone formation (see Phase II RFI/RI Report for OU 2 for detailed geological and hydrogeological information). The results of these samples are summarized in Table 2.3.3 and indicate an increase in volatile organic compounds (VOCs) in the groundwater after passing under the trench. The presence of VOC contamination in the upgradient well has been traced, as documented in Technical Memorandum 4, to the 903 Pad and other trenches. Nonetheless, the increase in concentrations in the groundwater downgradient of the trench indicates T-4 is a source of groundwater contamination.

Detailed soil sampling data is presented in Table 2.3.4. The contaminants of concern are volatile organic compounds.

Crushed drums and free product were encountered during the drilling activities at T-4, as recorded in the field logbooks from the field activities. However, the crews were not able to recover any free product for testing purposes. It should be noted that the sampling effort was not targeted for maximum concentrations which would have been a sample of the suspected free product present in the trench.

TABLE 2.3.3
T-4 GROUNDWATER SAMPLING RESULTS SUMMARY

Contaminant	Maximum Concentrations (µg/l)			
	Upgradient Well 3091	Downgradient Wells 3687	12691	Federal Drinking Water MCLs
Carbon tetrachloride (CCl_4)	450	3673	4500	5
Tetrachloroethene (PCE)	39	4654	1000	5
Trichloroethene (TCE)	51	221,860	560	5
Toluene	8	3100	25.3	1000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2,087,250
2,087,475
7,758,384
7,758,088
7,757,793
21993
21193
3687
Groundwater Flow
12691
BH4187
10391
12591
BH10995
BH14095
BH12995
BH13995
BH10695
BH10895
BH4287
10291
BH10595
BH10795
0308
Trench T-4/IHSS 111.1
B217589
BH13095
BH4587
Figure 2.3.2
Location of T-4
Boreholes and Wells
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
IHSS Boundary
Trench Boundary
Scale = 1 : 850
1 inch represents approximately 84.16 feet
25 0 50 ft
State Plane Coordinate Projection
Colorado Central Zone
Datum NAD27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
RMRS
MAP ID: new-trench
November 06, 19

TABLE 2.3.4
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
Volatile Organic Compounds (mg/kg)[5]					
1,1,1-Trichloroethane	NA	18	4	22.2	0.002(J)-2.3(E)
1,1-Dichloroethene	NA	18	1	5.6	0.009
Acetone	NA	18	3	16.7	0.026(J)-120
Carbon tetrachloride	NA	18	1	5.6	0.35(E)
Chloroform	NA	18	2	11.1	0.004(J)-0.77(E)
Ethylbenzene	NA	18	3	16.7	0.012-0.87(D,J)
Methylene chloride	NA	18	3	16.7	0.19(BJ)-8.2(B,J)
Tetrachloroethene	NA	18	11	61.1	0.001(J)-37
Toluene	NA	18	10	55.6	0.003(J)-0.67(J)
Trichloroethene	NA	18	8	44.4	0.02-680

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE 2.3.4 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations(5)	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
Semivolatile Organic Compounds (mg/kg)(5)					
2-Methylnaphthalene	NA	16	3	18.8	0.051(J)-0.29(J)
Bis(2-ethylhexyl)phthalat	NA	16	8	50.0	0.038(J)-0.76(B)
Naphthalene	NA	16	2	12.5	0.052(J)-0.15(J)
Phenanthrene	NA	16	4	25.0	0.13(J)-.57

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE 2.3.4 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
PCOC Metals above background (mg/kg)(3)					
Arsenic	13.2	16	15	93.8	3.6-11.5
Barium	289	16	16	100	34.4-153
Cadmium	1.7	12	6	50.0	0.35(B)-10.5
Lead	24.9	16	16	100	3.6-59.5
Manganese	901.6	16	16	100	66.5-944
Silver	24.6	14	10	71.4	0.91(B)-68.5

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE 2.3.4 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
PCOC Radionuclides above background (pCi/g)[2][3]					
Americium-241	0.012	16	16	100	0.002[J]-5.91
Plutonium-239/240	0.018	16	16	100	0.003[J]-16.6
Strontium-89/90	0.747	10	10	100	0.002[J]-0.586[J]
Tritium (pCi/l)	395.211	10	10	100	57.8[J]-211[J]
Uranium-233/234	2.643	16	16	100	0.449-191.7
Uranium-235	0.114	16	16	100	0.008[J]-11.5
Uranium-238	1.485	16	16	100	0.543-113.1

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
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(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

3.0 PROJECT APPROACH

The proposed action entails excavating volatile organic contaminated soil and material from Trenches T-3 and T-4 and processing it using thermal desorption. The project will be a source removal within the dimensions of the trenches, removing the contamination within the trenches and preventing further degradation of the surrounding soils and groundwater.

3.1 PROPOSED ACTION OBJECTIVES

The Trench T-3 and T-4 project will remove contaminated material from the trenches. The subsurface soils within the trenches have substantially higher concentrations of volatile organics than the surrounding areas as documented in Technical Memorandum 4, and groundwater sampling from upgradient and downgradient of the trenches indicate an increase in contamination as the water passes under the trenches.

3.2 PROPOSED ACTION

The proposed action for Trenches T-3 and T-4 involves excavating approximately 5,000 cubic yards of material from the trenches. A track-mounted backhoe will be used to excavate the soil from the trenches. The backhoe may be equipped with an opposable thumb, or clamshell, on the bucket for grasping and manipulating drums or other debris. The rate of excavation will exceed the rate of thermal desorption processing. Therefore, daily excavation will be limited to the volume necessary to maintain the thermal desorption process operating continuously as practicable. The contaminated excavated soil will be placed in roll-off or appropriate containers next to the trench site, then transported to the thermal desorption unit as needed.

Soils targeted for removal will be those located within the boundaries of the trench. However, field sampling and analysis will be used to ascertain which soils need to be removed that may extend beyond the boundaries of the trench. The concentrations of the soils will be compared with the soil cleanup standards developed for RFETS. These standards are based on reducing the future impact to groundwater and on the protectiveness of human health. Immobile or slightly mobile contaminants, such as metals and radionuclides, are below the subsurface soil cleanup levels. However, if routine field radiological screening indicates the presence of higher radiological contamination, which poses a risk to the remediation crew, the associated material will be isolated, sampled, and managed according to existing site procedures. Mobile contaminants, such as the volatile organic hydrocarbons and chlorinated solvents, will be cleaned up to soil concentrations that have been established for RFETS using site-specific values for soil types, hydraulic gradients, hydraulic conductivity, and source size to back calculate the allowable soil concentration for a specific impact to groundwater. Thus, the cleanup values used during this source removal are identified in the table below for specific contaminants of concern associated with the two trenches, T-3 and T-4. These values are currently being negotiated as sitewide standards and may be subject to change. However, it is anticipated that any changes will be minimal.

TABLE 3.2
CLEANUP VALUES

Contaminant	Soil Cleanup Standard (mg/kg)
1,1,1-Trichloroethane	378
1,1-Dichloroethene	11.9
1,2-Dichloroethane	6.33
1,2-Dichloroethene	9.51
Carbon Tetrachloride	11.0
Chloroform	152
Ethylbenzene	1760
Tetrachloroethylene	11.5
Toluene	2040
Trichloroethene	9.27

A mobile decontamination unit shall be set up adjacent to the excavation for the purpose of staging debris removed from the trenches. Debris that can be accepted by the TDU will be transported to the TDU for treatment. Otherwise, the debris will be decontaminated, then disposed in an appropriate manner. The soil removed from the debris will be collected and transported to the TDU for treatment. The wash water used to decontaminate the debris will be collected and treated at either the Building 891 facility or the Sitewide Consolidated Water Treatment Facility.

Throughout the excavation and reclamation activities, dust minimization techniques, such as water sprays and/or dust suppressants, will be used to minimize suspension of particulates. Earth moving operations will not be conducted during periods of high winds. The RFETS Environmental Restoration Field Operations Procedure for Air Monitoring and Dust Control provides guidance for monitoring of wind speed and work stoppage during high winds.

Dewatering of the trenches should not be necessary unless the groundwater is unusually high. If dewatering of the trench is necessary, a field sump will be created in the trenches and pumped out with a portable submersible pump into a temporary storage container(s). The fluids will be treated by the Building 891 facility or the Sitewide Consolidated Water Treatment Facility. Following treatment, the water will be sampled and released in accordance with respective discharge criteria. Alternatively, the water could be taken offsite for treatment and disposal if necessary.

Based on sampling data and experience gained during the characterization sampling effort, recoverable free liquids will be minimal. Void spaces in the trenches are not interconnected. Furthermore, most of the liquid is in saturated soils and is expected to remain in the soil when excavated. Therefore, the volume of free liquids is anticipated to be minimal. During the process of excavation, as lenses or pockets of liquids are disturbed, it is expected that any free liquids will be immediately absorbed by surrounding soils. Finally, since the walls and bottoms of the trenches have high clay contents, any liquid not immediately absorbed during excavation will be captured and removed. Any visibly stained or wet area of the trench boundaries will be excavated.

Excavation samples will be used to establish the post-action condition of the soils at the boundaries of the trenches and to control any extra excavation needed to achieve cleanup standards. Additional excavation will continue until soil concentrations are below cleanup standards or excavation encounters bedrock or groundwater.

The thermal desorption unit (TDU) will be loaded from the containers as the process demands and operated continuously, as practicable. The thermal desorption process will reduce the volatile and semi-volatile organic constituents of concern in the soil.

Following the processing of the soils through the TDU, the soils will be placed in clean containers. Each container of treated soil will be sampled and analyzed to verify that the soil meets the performance standards for treatment and allow the soil to be returned to the former trench location. Should the treated soil fail to meet these standards, the soil will continue to be processed until it meets the performance standards. The performance standards are the universal treatment standards for the contaminants of concern. These standards are listed below.

TABLE 3.4
PERFORMANCE STANDARDS

Contaminant	UTS (mg/kg)
1,1,1-Trichloroethane	6.0
1,1-Dichloroethene	6.0
1,2-Dichloroethane	6.0
Acetone	160
Benzene	10
Carbon Tetrachloride	6.0
Chloroform	6.0
Ethylbenzene	10
Methylene Chloride	30
Tetrachloroethene	6.0
Toluene	10
Trichloroethene	6.0

In addition to ensuring that the performance standards are met before the treated soil is returned to the empty trench, the soil will be sampled and analyzed for radionuclide content. Only those treated soils that are at or below the agreed-on accepted replacement levels for radionuclides (put-back levels) for subsurface soils will be returned to the trench. These action levels are currently being developed by the Rocky Flats Cleanup Agreement Working Group and will be available for use by the project this summer.

At the completion of remediation efforts, the trenches will be re-vegetated and all equipment will be decontaminated. Typical decontamination methods would include pressure washing of both the excavation equipment and TDU. Any filters from the off-gas treatment process or other material incapable of being decontaminated will be disposed according to RFETS standard low-level waste disposal procedures.

3.3 WORKER HEALTH AND SAFETY

Due to the contaminants present in the trenches, this project falls under the scope of the Occupational Safety and Health Administration (OSHA) construction standard for Hazardous Waste Operations and Emergency Response, 29 CFR 1926.65. Under this standard, a Site-Specific Health and Safety Plan will be developed which addresses the safety and health hazards of each phase of site operations and specifies the requirements and procedures for employee protection. In addition, the DOE Order for Construction Project Safety and Health Management, 5480.9A, applies to this project. This order requires hazard analyses which specify hazards to which employees may be exposed during each phase of the project and the appropriate control measures to be used. These documents will be integrated wherever appropriate.

This project involves potential worker exposures to physical, chemical, and radiological hazards. The physical hazards include those associated with excavation activities, use of heavy equipment, noise, heat stress, cold stress, and work on uneven surfaces. Workers will not need to enter the trenches, thus eliminating hazards associated with work in excavations and confined spaces. Appropriate personal protective equipment will be worn throughout the project. However, if field conditions vary from the planned approach, an Activity Hazard Analysis (AHA) will be prepared for the existing circumstances and work will proceed according to the appropriate control measures.

Continuous VOC monitoring will be conducted with an organic vapor monitor for any employees who must work near the contaminated soil (i.e. soil sampling personnel). Those employees will begin work in supplied air respiratory protection. Appropriate skin protection will also be worn. Following employee exposure evaluation, the Site Safety Officer may downgrade personal protective equipment requirements if applicable. Additionally, field radiological measurements will be conducted using a FIDLER or other appropriate equipment.

Dust minimization techniques will be used to minimize suspension of contaminated soils.

3.4 WASTE MANAGEMENT

Thermal desorption is an ex-situ process in which a contaminated soil or sludge is heated to a temperature sufficient to drive off volatile and semi-volatile organic compounds. Depending on the specific thermal desorption vendor selected, the treatment unit heats the soils to a temperature range between 200 and 1000 degrees Fahrenheit. The gaseous products are removed by a purge gas collection system and treated in a downstream off-gas treatment system. No incineration or destruction of VOCs occurs in the TDU. Again, depending on the manufacturer, the off-gases may be captured and cooled in a condenser and polished through an activated carbon filter and/or high efficiency particulate air filter. The processed soils from the TDU will be returned to the trenches. Debris decontaminated either through the TDU or through mechanical means will be disposed either in the site landfill, evaluated for offsite recycling, or returned to the trench.

Any ancillary wastes generated as part of this proposed action, such as personal protective equipment, will be characterized based on process knowledge and radiological screening. It will then be managed, recycled, treated, and or disposed according to RFETS policies and procedures and in accordance with Federal, State, and local laws and regulations.

Due to the elevated concentrations of the volatile organic compounds (trichlorethylene, tetrachloroethylene, and carbon tetrachloride) found in the two trenches, the soil removed from the trenches will be managed as if they contain characteristic hazardous waste. The main effort of this project will be to remove those hazardous wastes as well as other hazardous constituents from the soil by using a low temperature thermal desorption treatment process.

The residuals collected as part of the thermal treatment process, such as granulated activated carbon (GAC), the condensate, and the HEPA filters will be managed according to their waste characterization results. It is anticipated that the GAC and the organic-phase condensate will contain characteristic hazardous waste and will be disposed offsite at one of the disposal facilities contracted by RFETS. The aqueous-phase of the condensate will be treated onsite at the Consolidated Water Treatment Facility located in Building 891. The HEPA filters are anticipated to contain low levels of radionuclides and will be managed onsite until an RFETS contract is re-established with the Nevada Test Site.

Debris encountered during the excavation will be managed consistent with the treatment standards for hazardous waste debris (6 CCR 1007-3 Subpart 268.45). The debris will be decontaminated either through the thermal desorption unit or using a mechanical means.

4.0 ENVIRONMENTAL IMPACTS

The National Environmental Policy Act (NEPA) requires that actions conducted at RFETS be evaluated for potential impacts to the environment. Impacts to the natural environment resulting from the proposed action will be minimal. The impacts are not expected to result in any adverse impacts to wetlands, floodplains, threatened or endangered species or their habitats, or historic or cultural resources. There will be minor releases of air pollutants from heavy equipment operation during excavation as well as minor increases in particulates (dust) associated with the operation of loading, unloading, and transferring containers. Airborne particulates and contaminants resulting from the excavation activities will be controlled using best management practices, including water sprays and covering. Once the removal of the contaminant source from the trenches is complete and the processed material is replaced in the trenches, the sites will be returned to grade in the area and reseeded with appropriate vegetation.

5.0 COMPLIANCE WITH ARARS

In accordance with the Interagency Agreement (IAG), an objective of accelerated actions at RFETS is the identification and compliance, to the extent practicable, with Federal and State Applicable or Relevant and Appropriate Requirements (ARARs). ARARs relating to this proposed action are identified in this section and summarized in Table 5.1. There are no chemical-specific ARARs or location-specific ARARs for this proposed action.

The Colorado Air Pollution Prevention and Control Act standards for emissions (5 CCR 1001-3, 5 CCR 1001-9) have been identified as action-specific ARARs. Based on characterization data available from the trench vicinity, the anticipated air emissions will be calculated to determine what type of control measures will be needed to ensure compliance with the standards. This analysis, when completed, will be provided to the Colorado Department of Public Health and the Environment prior to the start of operations. In addition, 5 CCR 1001-14 will be followed to maintain the quality of ambient air in compliance with the National Ambient Air Quality Standards (NAAQS).

Additionally, the National Emission Standards for Hazardous Air Pollutants (40 CFR 61, Subpart H) have been identified as an action-specific ARAR to evaluate potential radionuclide emissions. The effective dose equivalent will be calculated for those emissions anticipated from the operations associated with excavation and the thermal desorption process. As a result of the radionuclides present in the trenches, radiation exposure guidelines contained in DOE Order 5400-5, Chapter II.1a, 1b, and Chapter III will be followed to ensure protection of the workers.

Remediation waste generated during this removal action will be evaluated under 6 CCR 1007-3, Part 261, *Identification and Listing of Hazardous Waste*, specifically Subparts A-C. Contaminated soil removed from the trench will be considered an environmental media containing characteristically hazardous levels of VOCs and will be managed as described below. Hazardous remediation wastes removed from the trench and generated as part of the waste processing will be stored in a *Temporary Unit* established under 6 CCR 1007-3, 264.553. This status is appropriate because of the short duration of operation of the unit, the limited potential for release from the unit and the type of unit being established (container storage). Additionally, hazardous remediation waste will be managed in accordance with the requirements of 6 CCR 1007-3, Part 264, Subpart I, *Use and Management of Containers* to ensure the safe and appropriate management of this type of waste.

Contaminated soils will be treated onsite using a low-temperature thermal desorption unit. This Unit is being established as a *Miscellaneous Unit*, regulated under 6 CCR 1007-3, Part 264, Subpart X. Environmental evaluations required by Subpart X status such as surface soil, geology and hydrology are contained in the RCRA Facility Investigation/Remedial Investigation Report for Operable Unit 2, particularly Chapters 2, 3, and 4. Operation of the Miscellaneous Unit will be conducted in accordance with 6 CCR 1007-3, Part 264, Subparts AA and BB, *Air Emissions Standards for Process Vents and Equipment Leaks*. Other relevant and appropriate requirements such as 6 CCR 1007-3, Part 265, Subpart P, *Thermal Treatment* will be incorporated to provide operating parameters which are appropriate for treatment using thermal desorption technology.

Hazardous remediation waste treated in the thermal desorption unit will be required to meet 6 CCR 1007-3, 268.48, the *Universal Treatment Standards* for VOC constituents prior to being returned to the trenches. These standards are required under the Land Disposal Restrictions program.

TABLE 5.0
ARARs for the Proposed Action of Trench T-3 and T-4

Action	Requirement	Prerequisite	Citation	ARAR
Air Quality	Compliance with air emissions	Prevention of exceeding emissions for particulates and VOCs	5 CCR 1001-3 5 CCR 1001-9	Applicable
Air Quality	Compliance with NAAQS	Maintain quality of ambient air for particulate matter	5 CCR 1001-14	Applicable
Air Quality	Compliance with air emissions	Calculations to determine radionuclide emissions do not exceed 0.1 mrem/yr.	40 CFR 61, Subpart H	Applicable
Radiation Protection	Compliance with radiation exposure levels	Ensure radiation exposure resulting from removal action does not exceed effective equivalent dose for 100 mrem/yr.	DOE Order 5400-5, Chapter II.1a, 1b, and Chapter III	TBC
Corrective Action for Hazardous Waste	Temporary unit container storage requirements	Operate temporary container storage area	6 CCR 1007-3, 264.553	Applicable
Hazardous Waste	Compliance with container management	Manage container condition, compatibility of waste, inspections, containment, and closure	6 CCR 1007-3, 264 Subpart I	Applicable
Hazardous Waste Treatment	Treatment to Universal Treatment Standards for VOCs	Perform process cleanup to achieve risk-based standards	6 CCR 1007-3, 268.48	Applicable
Hazardous Waste Treatment	Thermal treatment operating standards	Operate thermal treatment unit	6 CCR 1007-3, 265 Subpart P	Relevant and Appropriate
Process Air Emissions	Compliance with air emissions standards for process vents and equipment leaks	Operate treatment systems that contact hazardous wastes with organic concentrations of at least 10 ppm by weight	6 CCR 1007-3, 264 Subpart AA and Subpart BB	Applicable
Hazardous Waste Operations	Hazardous Waste Operating Standards	Operate Hazardous Waste unit	6 CCR 1007-3, 264 Subpart X	Applicable

6.0 IMPLEMENTATION SCHEDULE

The removal of contaminated soils in Trenches T-3 and T-4 is scheduled to commence in the first fiscal quarter of 1996 with documentation preparation. Field activities are scheduled to begin in the second fiscal quarter of 1996 with completion of the removal of contaminate soil in the last fiscal quarter of 1996. Data reduction and reporting efforts are scheduled to be completed the first fiscal quarter of 1997. These dates are projected from the work package. Any delays, scope, or budget changes may affect these dates.

7.0 COMMENT RESPONSIVENESS SUMMARY

During the public comment period between December 13, 1995 through January 12, 1996 for the Proposed Action Memorandum for the Source Removal at Trenches T-3 and T-4, the following comment was received and has been addressed as part of this Comment Responsiveness Summary.

The comment was received during the public information meeting, January 10, 1996 from Paula Elofson-Gardine and the response is as follows.

COMMENT

1. How will the open excavation of the trenches be addressed during the high velocity wind conditions typical for the Rocky Flats Environmental Technology Site?

RESPONSE

This question may have two components. The first component concerns workers' safety from a fall protection standpoint with an open hole in the ground and equipment shut down. The second component concerns potential contaminated particulate releases from the remaining soil in the excavation during a high wind condition. Each of these components is addressed as follows. A portable anemometer will be placed in a representative area relative to the work site. If a 15-minute average wind speed exceeds 15 miles per hour for two consecutive 15-minute periods, the soil handling operations will be terminated until the average wind speed is below 15 miles per hour for two consecutive 15-minute periods.

When the excavation and soil handling operations are shut down, the area will still be controlled as an exclusion zone. When work is not being conducted in the exclusion zone, workers move back to the support zone, thus preventing workers from getting close to the excavation during high wind conditions.

During excavation, dust control will be a paramount concern. Water sprays will be used on the trenches for dust control. Air modeling was done for the project to show what levels of airborne radiological contamination would result from the excavation and handling of the contaminated soils. The model used was the CAP-88. Parameters used in the model include the following:

- Distance to nearest receptor – The nearest receptor used for this model was the intersection of Indiana and 96th Street. This equates to a distance of 3,353 meters.
- Source type – The source type used was an area source.
- Meteorological file – This was an entire year's worth of data from 1994 which includes many high wind conditions.
- Contamination levels – The concentrations of all contaminants found in the trenches during characterization, including the radionuclides, were modeled.

The air modeling indicates that even without water sprays, the equivalent dose received at the modeled receptor was 5.35×10^{-4} mrem for the entire project's duration. This is well below the regulatory standard of 0.1 mrem. Thus, using conservative parameters and worst case conditions, the modeling indicates that the radiation dose resulting from the entire project, including high wind conditions, will be less than the regulatory standard.

In addition to the air modeling conducted for the project, air monitoring will be performed during the excavation and treatment process using both low and high volume air samplers. Select personnel required to wear respiratory protection will also be required to wear low volume lapel air samplers while soil handling is in process. The purpose of this sampling is to ensure worker safety by verifying that the breathing zone air of the worker is below acceptable levels.

High volume air samplers will also be used downwind of the work area to monitor any fugitive air emissions. These samplers are rated at 50-70 cubic feet per minute and are approximately 95 percent efficient. Two of the samplers will be placed directly downwind of the work area. The other two samplers will be placed approximately 60-90 degrees off the two directly downwind. In the unlikely event these monitors indicate a risk is present, work will be suspended until additional water sprays can mitigate the airborne contamination problem.